FAA AVIATION NEWS

APRIL 1971

COVER

The pride of the Finger Lakes—and how it grew. Page 4.

FAA AVIATION NEWS

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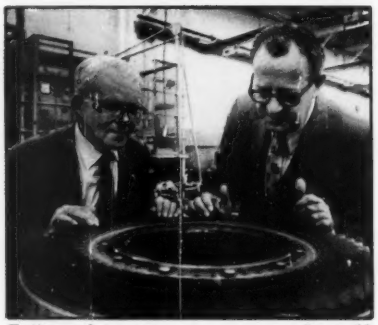

Father of an era Page 10

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When jets are climbing out of cloud cover on takeoff, you and your little plane want to stand on no legal ceremony based on weather minimums. Give the area a wide berth.

Everything that comes out of a cloud is not soluble.

Legal... but UNSAFE

Flying westward over Louisiana in the Cessna 182 the two women were not unduly concerned that they did not know their exact position. They were VFR at 2,500 feet, alternately flying on and off the OMNIs, picking their way through some widely scattered thundershowers. The clock told them they were about 100 miles west of their departure airport, Monroe, La., and their flight plan told them their destination, Dallas, was about an hour away. The latest weather report showed their route west of Shreveport as CAVU, and since their ceiling here was a good 3,000 feet or better they were not concerned about maintaining their VFR status.

The pilot, as it happened, had once been chided by her flight instructor for being "cloud shy," but she was over that fear now and demonstrated it by flying within one or two miles of the clouds before altering course. Sometimes the cloud obligingly moved out of their way in time to allow them to maintain course without losing the three miles of visibility, and 500 feet below, 1,000 feet above and 2,000 feet of horizontal separation from clouds required for VFR flight in controlled airspace.

But just now they were confronted with a rather large, dark cloud that meant business and forced them to detour south farther than they had anticipated. The pilot wondered out loud whether they might not be getting within ten or fifteen miles of Shreveport. Her volunteer copilot checked the chart, scanned the ground below and admitted that she was not certain. They were passing over a body of water, but was it the Red River—or was it Wallace Lake?

The question was answered for them with frightening speed. A black speck suddenly detached itself from the cloudbank on their right and zoomed up at them, flashing two bright white lights.

It was, quite obviously, an airplane—and a big one—coming at them. No time to estimate convergence angles—the Cessna pilot shoved her plane into a steep dive as her copilot grabbed for the papers and charts sliding off her lap. Both women watched with suspended movement as the climbing jet erased the gap between them in an incredibly short time and passed above and a little behind.

They had barely time to exhale their sighs of relief before another black spot detached itself from the cloud and the scene was repeated with nightmarish fidelity. They continued their dive as the airspeed indicator nudged the limit of the yellow line, and the bright lights of the second airliner flashed their warning before passing above and to the rear. Soon a third plane emerged from the rain cloud, but by now the 182 seemed to be clear of what must have been the departure funnel of Shreveport Airport's runway 13.

Ten minutes later, with the aircraft once again back on a straight and level course and hustling over the border into Texas, the two shaken pilots reconstructed the sequence of events which had led to the surprise of their lives:

They had known before they left Monroe that the first part of their flight to Dallas would be dotted with thunderstorms, but from all indications these were widely scattered and would present no real problem. The ceiling was adequate and the visibility good—3,000 feet and ten miles. They had changed OMNI frequencies en route and had monitored the weather broadcasts. They were using the Elm Grove VOR to steer around Shreveport's control zone, and they were perfectly legal in VFR conditions, well outside of the zone. Yet they had nearly been killed. Why?

Slowly they absorbed the understanding that *legal minimums are no guarantee of safety in the absence of good judgment.* The cloudbank over Shreveport meant that departing jets would have to depend on radar departure control for traffic information in and just beyond the cloud, and what guarantee is there that their small plane would show up clearly as a radar target, given the weather clutter and their relatively low altitude? But they *must* have been seen on radar—the flashing lights on the departing jets indicated they were on the lookout for trouble.

There is no merit in closing to within a tape measure 2,000 feet of clouds in VFR flight. The safe distance will always depend on the immediate circumstances and the flow of traffic in the area, not on rules and regulations alone. ■

the Skaneateles Story

How a wide spot in the meadow grew into the aeronautical showplace of the Finger Lakes country.

The snow cover all around the little upstate New York airport measures over 100 inches, but the runway has been freshly plowed and UNICOM invites you in. Before you have completed your landing roll, ramp attendants are beckoning you toward one of the two spacious hangars. They push your aircraft inside the hangar before you have had a chance to open your door, so that you step out on a dry surface, in case you forgot to bring the rubber overshoes everyone wears here in the wintertime. You are escorted to the pilot's lounge, and while you are busy shuffling your papers and checking your schedule, someone closes out your flight plan for you by phone. You notice with some amazement the modern decor that delights the eye—the weathered pine paneling, the acoustic board ceiling, the shining glasswork, the planters with real—not wax—greens, the comfortable chairs and the abundance of flight materials on hand at the counter. You begin to wonder whether you have blundered into some kind of private pilot's Shangri-la, and you brace yourself as you approach the manager's office, just in case he happens to be wearing a saffron robe and goatskin sandals.

But here you are disappointed. Jim Messenger, manager of the little Skaneateles airport, wears a plain business suit and represents, not the Dalai Lama, but Empire Aero Services, Inc. The red carpet treatment accorded transient pilots, as well as the local trade, is his idea of how to make friends out of pilots. So is the golf course-like appearance of the airport, with its delicate ponds, flowers and ornamental trees (not aligned with runway, of course) which has led to Empire Aero's gaining the first FAA Airport Beautification Award ever given a privately owned airport. In an era when many small private airports are having a hard time making ends meet, Empire Aero has found a winning formula for survival by paraphrasing Keats: "A thing of beauty is a joy to fly into."

Actually, it is probably the excellent reputation Empire Aero has acquired for repair services that is most responsible for the sound economic status of the airport, which has an FAA approved repair station rating as well as radio communications, navigation, and pulse ratings. Empire Aero Services, Inc., which owns the airport, is also a Piper distributor, but the shop repairs all manner of light aircraft, and the service department helps sustain the company when sales slack off.

Empire Aero had its beginnings back in 1947, when contractor A. S. Wikstrom, head of a large construction company, had a 2,300-foot east-west sod strip graded on a site overlooking Skaneateles Lake, a few miles south of the town. Wikstrom operated from the strip in a Navy SNJ Advance Trainer used in his business. Over the next few years he had a small 60′ by 60′ hangar built and acquired other aircraft, including a D17S Staggerwing Beechcraft.

In 1956 the runway was lengthened to 3,200 feet and partially paved; a 3,400-foot north-south sod runway was added, and the hangar was enlarged. But the airfield was limited to private use until 1961, when Wikstrom formed Empire Aero Services as a separate entity and opened the field to the public. Concerned with problems of getting what he considered adequate maintenance on his little fleet of aircraft, Wikstrom decided that one way of making sure that he had access to a first class repair station was to establish his own. By 1964 Empire Airport, with two large hangars (total floor space: over 160,000 sq. ft.) and two runways, was serving the needs of pilots for miles around.

At the suggestion of Wikstrom's energetic airport manager, James Messenger, a Piper distributorship was acquired at this time, and Empire was soon in the business of selling aircraft and supplying eight Northeastern dealers with airplanes and parts. By 1970, when Empire Airport received its FAA Beautification Award, the little airport was widely known and appreciated. Over 1,500 persons turned out on June 21, the day of the award ceremony, to help celebrate Federal recognition of Wikstrom's and Messenger's efforts to combine beauty and convenience with public service.

In presenting the award, FAA noted that Empire was living proof that an airport could be a good neighbor and a credit to the community aesthetically as well as economically.

A far cry from the dust and grime and ramshackle construction of early day airports, Empire is as attractive as a lakeside country club. As a temporary or permanent base for business aircraft operating in New York's Finger Lakes District, it has many appealing advantages over larger airports. There is a sense of courtesy and consideration displayed by Empire's employees that is reassuring. There is also a sense of dedication to the needs of business flying. The heavy winter snows, which can easily total 150 inches of snow in this area, do not provide an excuse for shutting down the airport. When his own tractors or trucks are not enough to keep the runways usable, Messenger hires additional equipment. It is expensive, he admits, but it is also very expensive to keep a corporate plane locked in when the company has important business elsewhere.

Empire believes in being a full-service airport. Flight instruction, ground instruction, and charter service are given the same careful attention as aircraft sales and maintenance. These departments may not bring any great income to the airport, Messenger

admits, but that is no reason in his view to slight them. You never know when a student pilot or a traveling salesman may turn into an airplane purchaser, and if you have impressed him with the thoroughness of one of your services, he is likely to be favorably disposed toward your sales office.

Professional men—doctors, dentists, lawyers, engineers, etc.—form an important segment of the airplane buying public at Empire. Many of them live near Skaneateles by choice, because of the beauty of the countryside, even though they may work in Syracuse (about 30 miles north) and they like to buy or base an aircraft near their home rather than near their work.

Even the local residents who have never flown in a small plane are aware of Empire Airport—not merely because of the FAA Airport Beautification Award, which is a great source of local pride, but also because of the active role the airport's management has taken in community fund-raising activities. The Rotary Club's annual fly-in breakfast in June is a typical example.

But apart from special events like this, it is the day-to-day thoughtful and dedicated conduct of all the people at Empire Airport —the gardener, the mechanic, the radio specialist, the pilots, the salesmen, the management—that makes the airport a good neighbor to the town and a mecca for all kinds of pilots. It is not Shangri-la, but it bears an unmistakable resemblance.

Lewis Gelfan

The FAA Airport Beautification Award Program is intended to enhance the public image of the local airport as an attractive gateway to the community. Any airport in the United States open to public use may apply for the FAA award, on the basis of having carried out a program for improving the appearance of the buildings or grounds in one of four particular areas:

Landscaping projects, which include removal of litter; screening of trash, scrap or other unsightly areas; planting of grass, flowers, shrubs and trees.

Pavement and Fencing, designed to make parking zones, access roads, and visitor areas more attractive, and to protect against injury from engine run-up.

Construction, which includes the restoration of old airport buildings in poor condition as well as new building and decor; also the elimination of hazards to aircraft, such as electric wires, and to personnel, such as unprotected ramp areas.

Miscellaneous projects, such as creation of special exhibit centers for vintage aircraft, civic-oriented projects involving the community, youth education projects, etc.

Sources of Federal, state and local financial assistance for beautification projects are listed in two pamphlets: "Federal Assistance in Outdoor Recreation" (35 cents), and "Directory of Private Organizations Providing Assistance in Outdoor Recreation to Individuals, Organizations and Public Groups," (30 cents). Both may be ordered from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

An airport may be nominated for the award by its management or by any interested individual or group. A nomination consists of:

1. A statement identifying the airport, giving location, age, type (commercial or general aviation or both), name and address of owner and operator. Also, a detailed description of the beautification accomplishments (within the previous 12 months) and the degree of community participation.
2. Appropriate color or black and white photographs—preferably contrasting "before" and "after" situations.
3. A proposed citation, 100 words or less, summarizing the major accomplishments.
4. Supporting evidence, such as correspondence, published articles, etc., if available.

Nominations should be sent to the Director of Public Affairs, DOT/FAA, 800 Independence Avenue, S. W., Washington, D. C. 20590. Airports which appear to qualify will be visited by a regional FAA official, and upon his recommendation the Administrator may approve the award.

Empire Aero began in 1956 as a sod strip, later added a hangar. Today it has two runways (one 3,600 footer paved), two hangars, a distributorship, and an excellent reputation for maintenance. About 25 aircraft are based on the airport.

The spacious, well lighted and heated repair hangar handles all kinds of general aviation aircraft. Behind the well-supplied flight counter (right) are Jim Messenger, airport manager, and Charles Dalton, sales manager.

The radio repair shop (left) at Empire Aero supplies and maintains avionic equipment. Complete engine overhauls are carried out (above) as well as airframe maintenance.

Weight Watching

Part II

Editor's Note: This is the second half of an article on weight and balance which began in the March 1971 issue. Part I dealt with the problems of lack of control and stability resulting from overloading aircraft or shifting the center of gravity too far. Part II describes the procedures for computing allowable loads.

Checking the overall weight of an aircraft sounds about as easy as checking your hat, and it may be no problem if the bird in question is one you own and fly regularly. But an airplane you rent or borrow may undergo all kinds of weight changes that escape your attention. Like people, aircraft tend to put on weight with years. A new radio, a transponder, wheel fairings, a DME —it is quite amazing how a few items can quickly add a hundred pounds to the empty weight given in your owner's manual, and reduce your payload accordingly.

The only way you can be certain about an aircraft's current weight (apart from hoisting it on a scale) is to check the current aircraft weight and balance report, aircraft logbook or major repair and alteration form for that aircraft. There is no such thing as as "standard" weight for an aircraft—no two apparently identical models will even leave the factory weighing exactly the same, and the weight variation will increase daily with time and usage. A coat of paint, for example, may add 10 to 20 lbs. to the empty weight.

The manufacturer may provide a *computed* empty weight for an aircraft upon delivery, which the owner can safely use as an original basis of calculation. This may include the basic structure, optional equipment, paint, hydraulic fluid, and residual fuel and oil. The computed empty weight, subtracted from the maximum takeoff weight, will give you your maximum allowable payload.

Then you must carefully tally up the weight of crew and passengers, baggage and cargo, usable fuel and oil. The total should be less than the allowable takeoff weight (for the conditions under which you intend to fly). But make certain you have not overlooked anything. For example, if you or your passengers are wearing special sports clothing, such as ski boots, you may have another 5 lbs. each to take into consideration. If your payload varies frequently, it will help to have printed forms on which to do your computation.

Fig. 1

Weight × Arm = Moment (lb./in.)

Item	Weight	Arm	Moment
Empty weight	1,340	38.5	51,590
Oil, 8 qts.	15	—20.0	—300
Front seats	320	35.0	11,200
Fuel, 40.2 g.	241	48.0	11,568
Rear seats	300	72.0	21,600
Baggage	60	92.0	5,520
Total	2,276		101,178

Given the basic data needed—the empty aircraft weight, the empty weight c.g. location (arm), the c.g. limits, and a diagram of the various load-bearing stations (see Figure 2), you can determine the center of gravity location for *any* payload within a few minutes.

You begin by jotting down on your form the weights of all items in the first column; and in the second column, their station, or arm measurements. (The arm is the actual distance in inches from the datum to a given item; the station is thought of as the point at which that item has its c.g.). Multiplying the weight times the arm for each item gives you the figure in the third column—the *moment* (Figure 1).

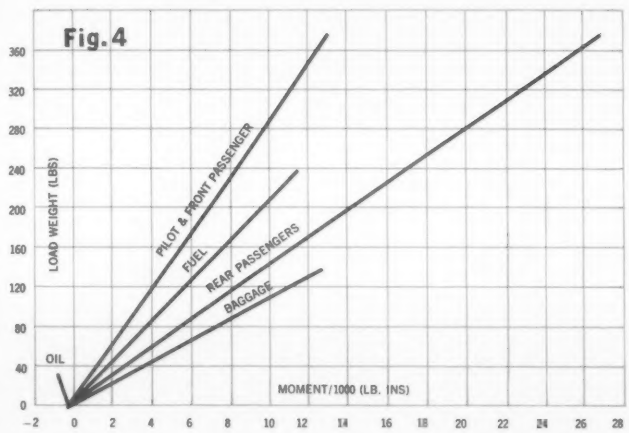
Adding all weights gives you a total of 2,276 lbs. in the example shown here; adding all the moments produces a total of 101,178 lb./in. The c.g. location is calculated by dividing the total moment by the total weight:

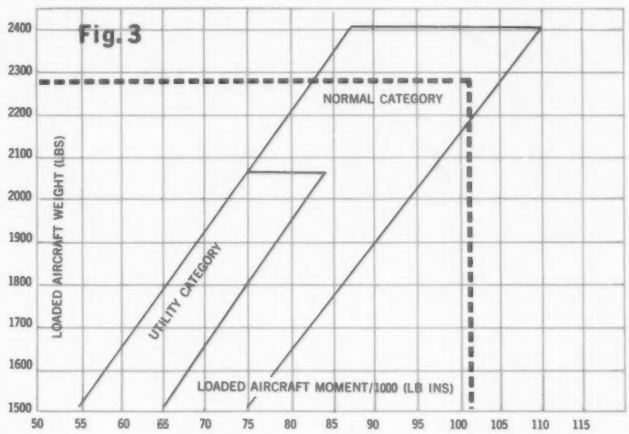
$$\frac{101,178}{2,276} = 44.5 \text{ in. aft of the datum}$$

From the data in Figure 2 it can be seen that both the total weight and the center of gravity are within allowable limits.

Weight and balance computations are greatly simplified by graphic aids, such as the *loading graph*, or the center of gravity *moment envelope*. The loading graph shown in Figure 4 is typical of those found in some general aviation aircraft owner's manuals. This graph makes it unnecessary to compute the moment by multiplying weight and arm for each item. The pilot simply notes where the appropriate horizontal weight line on the graph intersects the plotted item, and then follows the vertical line down to the moment index reading (the moment reduced by a factor of 1,000). He then adds up the total moment index, restores the reduction factor, and divides the total weight by the total moment, to derive the center of gravity location.

If he has access to a c.g. moment envelope graph for his particular airplane, his task is even simpler. He simply notes where the total weight and total moment index lines intersect in the graph, and observes whether this point is within the c.g. limits of the "envelope" (Figure 3.).





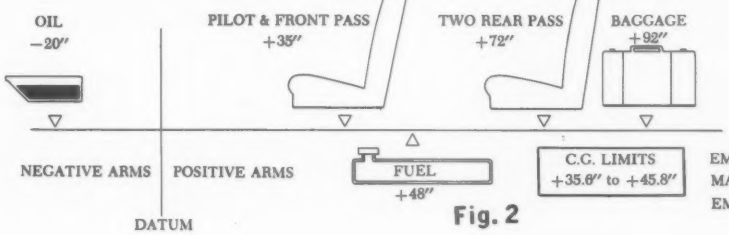
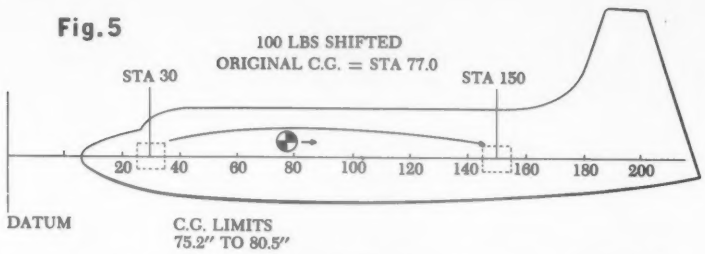


Fig. 2

EMPTY WEIGHT 1340 LBS
MAX T.O. WEIGHT 2400 LBS
EMPTY WEIGHT C.G. +38.5″



TOTAL WEIGHT = 8000 LBS × OLD C.G. (STA 77.0) = 616,000 LB IN

SETUP THESE NUMBERS READ ANSWER ON OUTER SCALE

$\frac{100}{8000}$ $\frac{\Delta \text{ C.G.}}{120} = 1.5$

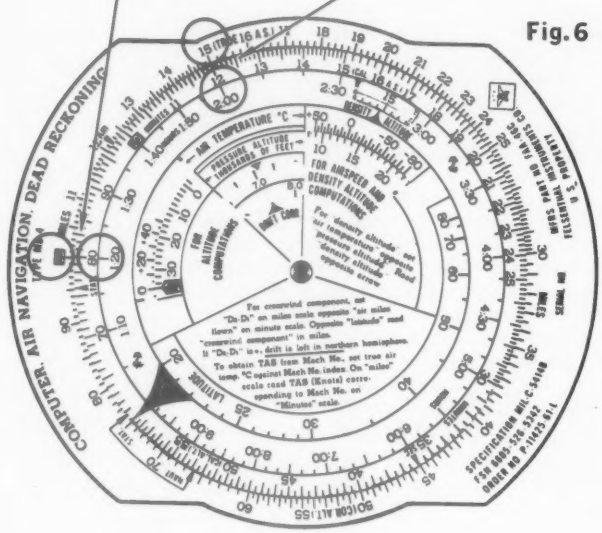


Fig. 7

LOADING SCHEDULE		
FUEL	PASSENGERS	BAGGAGE
FULL	2 REAR	100 LBS
39 GAL	1 FRONT AND 2 REAR	NONE
FULL	1 FRONT AND 1 REAR	FULL
INCLUDES PILOT AND FULL OIL		

Simplest of all to use is the loading schedule provided by some aircraft manufacturers (Figure 7). This schedule tells the pilot at a glance how much he can carry in the way of passengers, fuel and cargo, and how hos load can be arranged. Such a schedule is suitable only for determining a *basic* loading configuration. Owners of some planes are provided with a special weight and balance computer for their aircraft, which affords greater flexibility.

With larger aircraft, particularly when used in commercial operations, the operator must be capable of accommodating last minute changes in the payload without loss of stability or control. He must know the formulas for computing how far a given weight can be shifted within the aircraft, or how much additional weight can be loaded at a specific station, without exceeding the c.g. limits.

If, for example (Figure 5), it is desired to shift a special cargo weighing 100 lbs. from the forward compartment to the aft compartment, a distance of 120 inches, in an airplane with a total weight of 8,000 lbs., the following formula may be used:

$$\frac{\text{Weight shifted}}{\text{Total weight}} = \frac{\Delta \text{ c.g. (change of c.g.)}}{\text{Distance weight is shifted}}$$

$$\frac{100}{8{,}000} = \frac{\Delta \text{ c.g.}}{120}$$

$$\Delta \text{ c.g.} = 1.5 \text{ in. aft.}$$

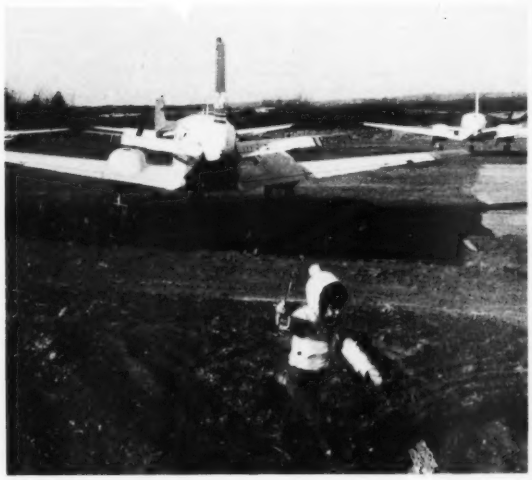
By setting up the lefthand equation on the two outer rings of any aircraft computer, the solution may be read on the outer ring above the figure 12 on the second ring. (To make certain you have placed the decimal point correctly, cross multiply the solved equation to make certain you have equal values on both sides.)

If the cargo were to be shifted forward rather than aft, the same figures would apply, except that the change of c.g. would be, of course, forward. Since the original

(Please turn to page 13)

Our Plane Has a

The patter of little feet, unattended, at an airport can spell trouble with a very large capital T.



According to some ancient and romantic propaganda, a young man's fancy in the springtime naturally turns to love, but any pilot's wife can tell you it ain't necessarily so. In the universal fraternity of flight, when the first robin's note is heard and the first crocus spied, it is not the love bug but the flying bug that bites the young in heart. On a warm spring day the urge to soar up into the wide blue sky is almost irresistible.

That is why, on this particular Saturday in April, the young dentist/airplane owner and his two small children were headed down the sloshy road to the county airport, ignoring the storm windows and other odd jobs waiting at home. They had some *important* work to do, getting their recently acquired airplane ready for flying—so they explained to the long-suffering lady of the house.

It was natural to stop by the operations shack for some bitter airport coffee and some mellow reminiscing over the bygone winter, while the kids—Toby, aged 5, and Tina, 4—rushed off to see the airplane, which they regarded as one of the family. Talk and coffee flowed, and it was more than an hour later when their father joined them at the sod cul-de-sac where the more or less inactive planes were tied down.

He found the children sunning themselves blissfully on the tail of an airplane—someone else's airplane, as a matter of fact. He pulled them down in a hurry, explained why this was a No-No, and suggested that they sit on a nearby log while he checked over their shiny new—well, not quite so shiny now, but still nearly new Mooney.

As a well-read airplane owner, he was determined not to fall into the classic mistakes of the impatient birdmen who tried to take off with the nest of swallows in the exhaust stack, or some other reminder of a winter wildlife visitation. Checklist in hand, he began by removing the cowling and inspecting every niche and cranny of the engine area for foreign objects. Then he worked his way slowly and methodically toward the tail, checking surfaces, ports, hinges, fastenings —almost every square inch of the plane.

Finally he unlocked the cabin door and climbed inside, noticing with satisfaction that the luxurious odor of new upholstery was still present. He found himself trembling with eagerness to hear the engines roar, but he forced himself to go through his pre-start checklist step by step before he pushed the starter button.

Nothing happened, of course, since he had not reinstalled the battery he had taken out last November. He proceeded to do so, with a new-found sense of humility, and took time to pull the prop through a few times before returning to the pilot's seat. His thumb was hovering over the button again when suddenly a thought struck him and his hand froze—the kids! He had clean forgotten about them. Yelling "clear" was just as likely to bring them running in the direction of the prop as to warn them away, he realized uneasily, as he shut everything down and climbed out.

Toby and Tina were still sitting on the log, smiling angelicly and throwing rather large stones at the nearest airplane, which happened to be fabric-covered. Their father herded them guiltily away, not daring to check for holes. He noticed that Toby's pockets were bulging suspiciously, and as they neared their own plane the boy broke loose and ran over to deposit something in the baggage compartment.

"Just a minute, Toby. What have you

s a Tummy Ache

got?"

"Something for our plane."

"Show me."

The boy held up what appeared to be a rudder gustlock—not their own.

"Where did you get it?"

The boy shrugged innocently.

"Toby—you've got to remember. We have to put it back. Where did you get it? Was it that nice red plane over there?"

Toby nodded sweetly, but Tina said, "It was the yellow plane."

"Is that right, Toby?"

"I think it was that yellow plane."

"All right, let's put it back."

"But Tina," Toby said, "we got *something* from the red plane."

Their father knelt down and stared into the children's faces at eye level. "You've been collecting things from other planes?" he said, trying to keep the hoarseness out of his voice.

Both children nodded proudly.

"Oh, my God."

"But," said Toby, "Tina said our plane *needs* things."

"We put them inside her tummy," Tina explained to her father. "She was hungry."

With a sinking heart he opened the baggage compartment. Inside was a massive collection of airplane parts: gas caps, oil filler caps, dipsticks, half a dozen pitot tube covers, two sets of headphones, one microphone, a seat cushion, bits of wire (someone's radio antenna?), several owner's manuals and one well-used flight computer, a compass, some charts, some tools, three red navigation lights and one green one (Toby was partial to red), assorted nuts and bolts, screws. . . .

There was more—much more—but he did not bother to look. Some of the goods were "hand-removable" and their owners could be faulted for leaving cabin doors unlocked, but most of the stuff had been wrenched loose from an airplane with the astounding strength and persistence of a dedicated five-year old who had been turned loose in a tie-down area with an imaginative young companion while their negligent father was taking his ease in the operations shack. Trying to put each object back in or on the plane it belonged to was out of the question. There was only one thing left to do.

He locked the airplane doors, *including* the baggage door this time, escorted the children to the car, and then spent an unhappy half hour in the office of the airport manager. They arranged to send out a registered, special delivery letter to the owner of every airplane in the cul-de-sac, warning them that their aircraft had been exposed to juvenile pilferage, and to check carefully, with the aid of a mechanic if they wished, for every conceivable kind of missing item, from gustlocks to hinge fastenings, before attempting to fly—expenses of said investigation and recovery to be borne by the undersigned. Regretfully yours, etc.

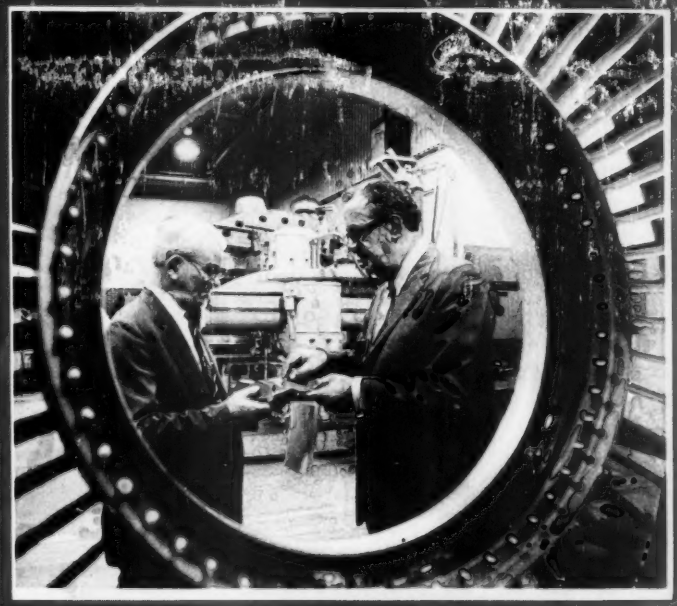
The airport manager did not think anyone would be too hard on the father, they were all fellow flyers who would understand—but maybe he should leave the keys to his airplane in the office, anyway, for the time being. *And would he like a cup of coffee before going . . .? Well, some other time. Don't worry!*

When a very silent father and two silent young children arrived home an hour later and marched up the stairs in single file, a very understanding wife and mother did not trouble them with such questions as "Did you have a good time?" The only intelligence she received was a laconic announcement from Toby, over his shoulder, that "our plane had a tummy ache." From this she gathered that on Sunday there would be a man around the house available for spring chores. For his sake, she hoped it would rain.

Famous FLYERS

the Flight of the Squirt

Sir Frank Whittle's propless marvel that blazed the trail for the jet age.



On a recent visit to this country, Sir Frank (left) was brought up to date on jet engine developments by an official of American Airlines.

The practical use of jet propulsion by man goes back as far as 120 B.C. when a philosopher in Alexandria named Hero put together a gadget he called an Aeolipile (ball moved by wind). His apparatus consisted of a mounted sphere which spun around as steam escaped from two nozzles on either side of it, much like today's whirling lawn sprinkler. Some translations of Hero's notes credit the aeolipile with opening a temple door.

In China many centuries later—around 1200—the first skyrockets were made from charcoal, sulfur and potassium nitrate mixed in a tube and ignited. By attaching a stick to the tube, an undesirable boomerang effect was eliminated.

By the time of the Ming dynasty (1368-1644), a farsighted gentleman saw rockets as a possible means of fast effortless transportation. He had his servants fasten rockets to the back of a chair set on runners. He seated himself and ordered the rockets lit, and was instantly propelled into oblivion.

Sir Isaac Newton, in the 17th century, expressed the physical basis of jet propulsion in his third law of motion; "For every action there is an equal and opposite reaction."

In 1928, a 21-year old cadet at the Royal Air Force college in Cramwell, England, submitted a final thesis, entitled "Future Developments in Aircraft Design", dealing primarily with the possible use of gas turbine engines for aircraft propulsion. In this extraordinary paper Frank Whittle theorized about the jet exhaust that would result if compressed air were directed to a combustion chamber where fuel would be added and the resulting mixture ignited. He claimed such an engine would be capable of propelling a high altitude aircraft at speeds up to 500 mph. With the current top speed of an aircraft accepted as 150 mph, Whittle's theory was not taken too seriously.

For the next two years Whittle, assigned to an RAF flight training school as an instructor, continued developing ideas on a turbojet engine and by 1930 was able to apply for a patent. He approached the Air Ministry with his plans but was unable to get financing from them—or anyone else. The problems to be overcome were enormous; materials which could withstand the high stresses and temperatures required for an efficient gas turbine were non-existent.

By January of the next year the patent renewal fee was due for the engine. Whittle, now a flight lieutenant, had become reconciled to the fact that he was far ahead of his time in considering a turbojet and let the patent lapse. His decision was also influenced by the refusal of several commercial firms to finance an experimental engine and the fact that, supporting a wife and two sons on a junior officer's pay, Whittle could not afford the $22 renewal fee.

Six months later, two former RAF pilots, J. C. B. Tinling and R. Dudley Williams, offered to act as Whittle's agents in securing financing for the jet engine. Whittle agreed and they directly set out to renew the lapsed patent and to raise the $225,000 required to develop a jet-propelled airplane.

There were still major obstacles in the way of finding materials that could withstand the high temperatures necessary for a turbine more efficient than existing ones, but there was always a chance that the engine itself would be an incentive for the development of such materials.

In March 1936, the trio persuaded an investment firm to back their enterprise, and Power Jets, Ltd., was formed with an authorized capital of $45,000. Whittle was to act as Chief Engineer and Technical Consultant over an initial period of five years.

The next step was finding a company that would design the engine. The British Thompson-Houston Company agreed, and Power Jets, Ltd., set up shop at their factory in Rugby. Whittle spent the next few months traveling from Cambridge to London to Edinburgh to Rugby trying to get the components made. Meanwhile, to his great relief, the Air Ministry gave him permission to spend another year of graduate work at Cambridge. It was a sign that they approved of his project.

By October the combustion tests were already being carried out at the factory in Rugby. If the factory workers had not considered Whittle crazy by this time, the events that followed convinced them. Only a few of those actually working on the engine knew what it was—many thought it some kind of diabolic flame-thrower. And flames it threw. During tests Whittle and his fellow engineers could be seen dancing between pools of fire that would spring up all around the engine from leaking fuel.

In the factory planning office above the test area labor unrest was rife. The combustion tests often resulted in a deafening noise that would stop work in the entire plant. Accompanying this were clouds of fuel vapor that would pollute the offices

and a vibration that caused all loose objects to "walk" off the desks. Whittle had a job cut out just trying to calm down the ladies of the work force when they staged a walk-out over these inconveniences.

The first engine was ready in mid-spring of 1937. A new steel alloy called "stay blade," developed for the turbine wheel-blades, was expected to withstand the stress of turning at the rate of over 16,000 revolutions per minute, as required by Whittle.

Now the testing was really exciting. When the engine would reach around 2,000 rpm, the revolutions would increase rapidly and zoom out of control, threatening to explode the engine and send off particles at the speed of a rifle bullet. Everyone would dive for cover. Fortunately the engine always stopped before it got too far.

By the end of 1937 Whittle was promoted to squadron leader and was given family allowances. This took care of his domestic worries but the corporate difficulties were growing. Earlier in the year private investors had begun to withdraw their funds from Power Jets, Ltd. The Air Ministry stepped in and offered to finance the work, albeit with a limited budget and some scepticism.

In June 1939, Whittle's engine survived a test run at 16,000 rpm—without running away once! This gave the Air Ministry courage to finance a test-bed plane to be constructed for the engine. In July, George Carter at the Gloster Aircraft Company was given an order for an aircraft that would weigh 2,800 lbs. The engine alone would weigh 623 lbs. and have a thrust of 855 lbs.

Meanwhile, the Germans had been working almost exactly in parallel, and on August 27, 1939, Erich Warsitz, a Luftwaffe test pilot, made the first flight in a jet plane, the He 178, powered by a jet engine designed by a young physicist, Hans von Ohain. Although similar in principle to Whittle's engine which employed a centrifugal compressor driven by the now conventional axial turbine, von Ohain's engine used a centrifugal compressor driven by a peripheral (radial) turbine in much the same manner as the turbo-superchargers used on high-altitude bombers of the day. It was not a successful design, and thereafter the Germans concentrated on engines with axial flow compressors and turbines.

Top left—The W1X Whittle jet engine presented to The Smithsonian Institution in 1941. Top right—The Gloster-Whittle E28/39 *Squirt* powered by the W1 engine, a propless marvel. Above—Whittle's first experimental unit constructed in 1937. Right—the vital ingredients for development of the jet engine—the young inventor, the telephone and slide rule. Search for special parts, materials and financing was part of his task.

The British took more time to turn out a jet plane but they found it time well spent. On the evening of May 15, 1941, at Cranwell RAF Base, England, after waiting all day for the clouds to lift, Gerry Sayer, chief test pilot for Gloster Aircraft Company, squeezed into the cockpit of the tiny jet plane officially called E28/39, but nicknamed the *Squirt*. Gathered to watch the flight was the group of engineers who had worked for four years to develop the gas turbine jet engine that would power the *Squirt*. With hands over their ears, they saw Sayer rev Frank Whittle's W1 engine up to 16,500 rpm and then let up on the brakes. After a 17-minute flight he touched down with a successful plane.

The jet age had irrevocably arrived.

It took Sayer the next 12 days to get 10 hours of flight in the *Squirt* (because of poor weather) but at the end of that time he had reached a top speed of 370 mph at 25,000 feet. The E28/39 performed even better than predicted by Whittle.

Whittle next designed the W2B jet engine, which would power the *Meteor*, a twin-engine interceptor fighter, with a planned thrust of 1,600 lbs. The *Meteor* went into service in May 1944 and was effectively used against the V1 flying bombs which were pelting England with terror and destruction in the last days of WW II.

Shortly after the successful flight of the *Squirt* in 1941, the W1X—an experimental version of the W1 using components of the W1 which were not airworthy—was sent to the United States for reproduction by General Electric. It became the basis of American turbojet development. In 1942 Whittle traveled to the United States for a few weeks to assist with the duplication.

Meanwhile he had become increasingly dissatisfied with the technical policy of Power Jets since 1941. The Air Ministry eventually took over the company and, in 1944, in a derisive gesture, Whittle surrendered his rights, forfeiting all monies. For the next four years he supported his family by giving lectures to packed houses all over England on development of the gas turbine. He was forced to accept a medical retirement on August 26, 1948, with the rank of Air Commodore. He also received at this time approximately $450,000 tax free for his part in the development of the jet engine. In July he was designated Knight of the British Empire for his pioneering work in jet propulsion.

He lives today in retirement in Coventry, and makes frequent visits to Jamaica—thanks to the convenience of speedy jet transports whose existence he had envisioned 40 years ago. M. W.

This is the first of a series on the development of the jet transport. Future articles include the British Comet *and the American jet air carriers.*

INSPECTION AIDS 7

A series of articles on maintenance problems of general aviation aircraft.

A runaway seat is no laughing matter on a critical maneuver

Backseat Flying

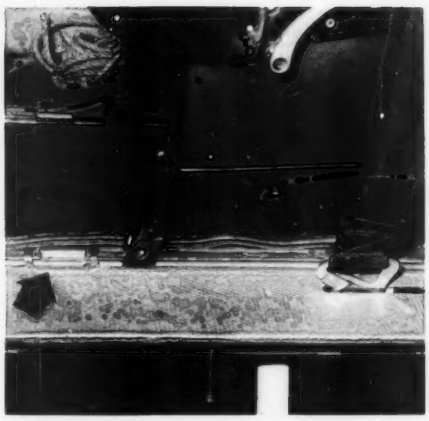
Any takeoff has its measure of excitement but an additional and unwelcome thrill can be added if during the power surge the pilot's seat shoots back and pulls him out of reach of his controls. Accidents of this kind do happen; they are embarrassing at best, and can be very serious if there is no copilot to take over. Inspecting the seat framework and sliding mechanism is not one of the regular items on a preflight checklist, but it is a good habit to firmly test the seat with back pressure whenever you adjust it. It is also a good idea to look under the seat once in a while, noting how the mechanism works and whether it all appears to be in good condition.

In most of today's light planes, floor-mounted tracks are used in the adjustment of the front seats, which move forward and back on rollers bracketed to the seat. The seat is stopped in the desired position by a locking device linked to a bar or handle for use by the pilot in releasing or locking the seat in place. Most seats are locked by pins which slip down into holes in the track, although a few use other devices such as clamps or "shoes." A security stop at the end of the rails prevents the rollers from overrunning the track.

The adjustment mechanism is usually springloaded, so that when the handle is released the pins drop automatically into the nearest locking slot. However, in some cases there is no spring, and the pins must be manually positioned or the seat will slide under pressure.

A rental or club plane, flown by pilots of varying size, will have its front seats shunted back and forth frequently, subjecting the movable mechanism to considerable wear and occasional abuse by an impatient birdman. This may lead to the end stops becoming weak and susceptible to overriding, or to the intermediate stops becoming enlarged and prone to slippage. For these reasons, a periodic check of the seats is a good practice. Your inspection may include:

1. The metal framework of the seat, particularly the joints, since tubular metal can crack under stress.



The rear stop (arrow) on some seat tracks could be overriden by takeoff thrust if the seat is not securely locked in place.

2. The rollers and roller brackets. Check for proper alignment and wear, such as chips or cracks, in the rollers.

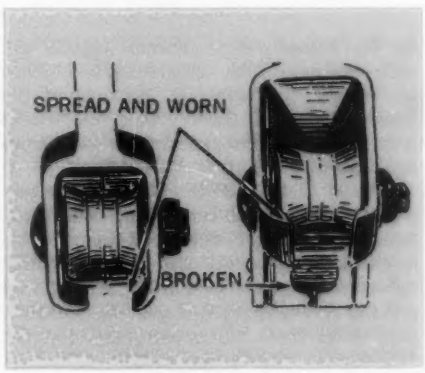
3. The locking mechanism, including the actuating arm, linkage and locking pins. Make sure the release spring, if there is one, is intact, and the action is positive.

4. The floor-mounted rails. Make certain they are tight to the floor and tracking true. The rail stops should be clear and not distorted, and the end stops solid.

While you have your nose down on the floor, this is a good time to remove any foreign or loose objects hidden under the seat. Coins, combs, keys and other abandoned miscellany take a malicious delight in jamming vital mechanisms at the worst possible time. Backseat flying, with no one up front, is no fun at all.

(Related incident reported in General Aviation Inspection Aids Summary, August 1970, page 28. Complete sets of these reports (AC 20-G) are available from the Superintendent of Documents, Washington, D. C. 20402. Domestic subscription is $3.00, foreign $3.75). ■

Broken brackets or worn rollers should be called to the attention of a mechanic.



Weight Watching

(Continued from page 7)

c.g., before the weight shift, was at station 77.0, a 1.5 in. shift will not exceed the normal limitation. Other formulas will disclose the exact amount of weight that could be shifted safely, the effects of partial instead of full fuel tanks, possible seating arrangements for the passengers with any given load, etc.

These formulas are provided in "The Pilot's Weight and Balance Handbook," issued as Advisory Circular 91-23 by FAA's Flight Standards Service. The handbook, which covers weight and balance as it applies to both large and small aircraft, is sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price, 70 cents. ■

DEFINITIONS

1. **Center of Gravity:** the point about which an airplane would balance, if suspended.
2. **Center of gravity (c.g.) limits:** the specified forward and aft points within which the c.g. must fall, if the aircraft is to operate normally and safely.
3. **Datum:** an imaginary vertical line, within or in front of the aircraft, from which all horizontal measurements are taken.
4. **Arm:** the horizontal distance in inches from the datum to the c.g. of the aircraft or any item in it. A plus sign (+) indicates measurement aft from the datum; a minus sign (−) is shown when the measurement is forward of the datum.
5. **Moment:** the weight of an item multiplied by the arm, expressed in pound-inches.
6. **Standard weights:** gasoline, 6 lb./U.S. gal.; oil, 7.5 lb./U.S. gal.; water, 8.35 lb./U.S. gal.; jet fuel, 6.7 lb./U.S. gal. Standard passenger weight, 170 lbs., should not be used when *actual* weight can be ascertained.
7. **Station:** a designated horizontal distance from the datum, expressed in inches. An item located at station +50 would have an arm of 50 inches.
8. **Useful load:** the empty weight of the aircraft (without pilot, crew, passengers, usable fuel, drainable oil and baggage or cargo) subtracted from the maximum allowable takeoff weight.
9. **Index:** the moment reduced by a given decimal factor (10, 100, 1,000, 10,000, etc.). A moment of 32,120 lbs./in., for example, would have an index of 32.12 with a reduction factor of 1,000.

Pilot BRIEFS

■ BEFORE THE EXAM. A new "Federal Aviation Regulations Written Test Guide for Private, Commercial and Military Pilots," AC 61-34A, has replaced the 1967 Guide. The AC outlines the scope of the basic knowledge required of pilots who are studying FARs for examinations. It also provides sample test items and references recommended for use in a study program. AC 61-34A is for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 for 40 cents.

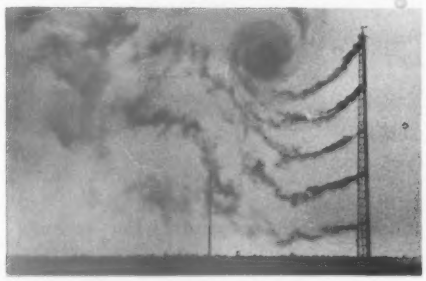
■ PACKING IT IN. An advisory circular providing a revised listing of all FAA certificated parachute lofts as of October 1, 1970 is now available. Lofts are rated for packing and general maintenance, canopy overhaul, harness overhaul, metal parts and container overhaul, and drop testing. Copies may be obtained by requesting AC 149-2E from DOT Distribution Unit, TAD-484.3, Washington, D. C. 20590.

■ A CONSOLIDATED LISTING of FAA certificated Repair Stations, AC 140-1E, can also be obtained free from the above address. The Advisory Circular contains the names and addresses of over 2,000 shops in the United States which are FAA-rated to perform maintenance work on airframes, powerplants, propellers, radios, instruments or accessories. Some 50 repair stations abroad are also listed.

■ LOST AND FOUND. FAA is issuing a Notice of Proposed Rule Making that would set standards for emergency crash locator beacons to be required on most new general aviation airplanes by the end of 1971 and on existing airplanes by 1973. The rule would exclude most Part 121 airplanes, jet powered airplanes, military airplanes, agricultural airplanes, and training airplanes that remain within 20 miles of home base.

■ ALTITUDE ALERT SYSTEM FOR JETS. The compliance date for FAR Part 91.51 has been extended until August 31, 1971. The rule calls for all civil jet planes to be equipped with an approved device to warn pilots both audibly and visually as they approach a pre-selected altitude.

■ ROUGHRIDING. A new film describing wake turbulence has been made available by the FAA for use by flying clubs, flight schools, operators, state and local agencies and similar organizations. The wake turbulence problem in the air and on the ground is illustrated by means of special photography and animation in "Caution: Wake Turbulence" which pools research findings of latest tests by government and private industry. Requests for loan prints should be addressed to the FAA Film Library, AC-921 at the FAA Academy in Oklahoma City.



FAA Domestic Regions of Jurisdiction Undergo Change.

The 5 FAA regional administrative jurisdictions in the 48 adjacent states have been realigned to 9 regions. The new *Northwest Region,* with headquarters in Seattle, includes Oregon, Washington and Idaho in its jurisdiction. The new *Rocky Mountain Region* contains Montana, North and South Dakota, Wyoming, Utah and Colorado, with headquarters in Denver.

Chicago is the head office of the new *Great Lakes Region,* comprising Illinois, Michigan, Minnesota, Wisconsin, Indiana, and Ohio. A *New England Region,* with headquarters in Boston, is made up of Maine, Vermont, New Hampshire, Massachusetts, Connecticut and Rhode Island.

Existing Regions will remain Western, Central, Southwest, Southern, and Eastern.

Changes Proposed in Terminal Control Area Flight Rules.

FAA is considering three revisions to Part 91 of the Federal Aviation Regulations that would affect flight within a terminal control area by turboprops and by aircraft without transponder capability.

Docket No. 10849; Notice 71-3, seeks to change Section 91.90 which specifies that large turboprop aircraft (as well as pure jets) must operate above the designated TCA floors at all times while within the lateral limits of a terminal control area. FAA has found that some turboprops do not have the same climb capability as turbojets and have been forced to utilize off-course climbs and other maneuvers in order to comply with the rule. The agency is proposing to classify turboprops with reciprocating engine aircraft for the purpose of allowing them to depart the area beneath the TCA floors.

Docket No. 10850; Notice 71-4, concerns transponder requirements within terminal control areas. This proposed amendment would more clearly delineate the extent of permissible flight within a terminal control area by nontransponder-equipped aircraft. It would clearly exempt the following aircraft from this requirement: all IFR aircraft operating to or from a secondary airport located within the control area, and IFR aircraft operating to or from an airport when the commonly used transition, approach, or departure procedures to such an airport call for flight within the terminal control area.

The third Notice of Proposed Rule Making (Docket No. 10851; Notice 71-5) concerns transponder failure. With regard to those aircraft required to be transponder equipped, the existing rule permits an aircraft incurring a transponder failure while inbound to a terminal control area to continue the approach and land, but does not authorize a subsequent departure so long as the transponder is not functioning. Since it is at times impractical to have the transponder repaired before the aircraft reaches its final destination, FAA is proposing new language which would permit a continuation of the flight when specifically approved by air traffic control.

Persons interested in participating in any of these proposed rule changes should submit their views to FAA in writing by April 19, 1971. Comments in duplicate may be addressed to FAA, Office of the General Counsel, Attention: Rules Docket GC-24, 800 Independence Ave., S.W., Washington, D. C. 20590. Identify each proposal by docket and notice number.

New Handbook Will Help Train Airframe, Powerplant Mechanics.

FAA has recently issued a general handbook to help applicants for an FAA airframe and powerplant mechanic certificate prepare for the written tests.

The "Airframe and Powerplant Mechanics-General Handbook," 1971, AC 65-9, contains basic study information relating to electricity, aircraft drawings, weight and balance, fluid lines and fittings, materials and processes, ground operation and servicing, cleaning and corrosion control, mathematics, maintenance forms and records, physics, maintenance publications, and mechanic privileges and limitations.

In ordering by mail, a check or money order for $4.00 ($5.00 foreign) must be sent to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The GPO Catalog No. is TD 4.8:AI 7/18. The advisory circular may also be purchased at any one of the GPO Bookstores in Chicago, Boston, Kansas City, Mo., Los Angeles, or San Francisco.

Preplanned SVFR Departure System Tested at Two California Airports.

In an effort to simplify Special VFR (SVFR) operations and to reduce congestion on ground control frequencies, a "Card-A-Clearance" system of SVFR clearances is being tried at two of California's busiest and smoggiest airports, Long Beach and Torrance. (During September 1970, Long Beach had 97 hours of SVFR weather and 2,140 SVFR clearances.)

The new system involves pre-planned SVFR departures, tailor-made for each airport, and coded with a name such as "Freeway departure." Pilots use a "Card-A-Clearance" card with their name, signature, license number and specific departure details. Departure clearances, when given and accepted, constitute an ATC clearance. An "IFR-to-on-top" clearance can be used by card holders who are instrument rated. Normal old-style SVFR clearances are still available.

If the evaluation is successful, the system may be used at other airports.

NEW HIGH-LIFT AIRFOIL is a feature of the recently certificated American Trainer. Two-placer bears a family resemblance to the American Yankee, but was especially designed for school use and at 1,500 lbs. gross is one of the lightest of today's trainers.

• Open Door Policy

Congratulations on the usefulness of the Forum—and please tell me this: What are the considerations and requirements before certifying an aircraft (light high-wing type) to fly with one cabin door removed? Can a Cessna Skyhawk 172 be used safely for skydiving?

Name withheld
Caracas, Venezuela

The Cessna 172 is included in the list of aircraft eligible to be operated with one cabin door removed for skydiving. Authorization with operating limitations for the use of such aircraft for parachuting may be obtained by writing to the FAA General Aviation District Office having jurisdiction over the area in which the plane will be operating and by giving the following information: name and address of registered owner of aircraft; make, model, and registration number of aircraft; place where aircraft is normally based; and reasons the aircraft is to be operated without a door.

In addition, the installation and removal of seats, control wheels, jump steps, deflectors, etc., must be handled in accordance with applicable sections of Part 43 of the Federal Aviation Regulations. Advisory Circular 105-2, "Sport Parachute Jumping" (free upon request from DOT/FAA Distribution Unit, TAD 484.3, Washington, D.C. 20590) contains full details on this subject.

• The Truth About The J-2

I am interested in obtaining a report on the McCulloch J-2 Gyroplane, certificated in May 1970.

The information obtained from the McCulloch Aircraft Corporation in Lake Havasu, Arizona, provides only the most favorable advertising of their product. I am interested in an unbiased report on this aircraft.

Jeanne Strong
Los Altos Hills, Calif.

Information on the flight characteristics or performance capabilities of the J-2 may be obtained from FAA's Aircraft Engineering Division, WE-100, Western Regional Office, P.O. Box 92007, Worldway Postal Center, Los Angles, Calif. 90009. A first-hand flight account of the J-2 Autogyro was published in the February 1971 issue of Flying *magazine.*

• Shoulder Harness Requirement

Few if any general aviation aircraft are equipped with shoulder harness safety belts. Does the use of shoulder harnesses reduce injuries during emergency landings? Are there any plans for FAA to make them required equipment?

John V. Kjellman
Mountain View, Calif.

On August 1, 1969, a new regulation was issued applicable to general aviation aircraft type certification that would require the installation in new aircraft of effective upper body restraints (harnesses), or provide an airplane interior design that would either eliminate injurious objects within striking radius of the head or provide energy absorbing support for the upper torso.

FAA is currently processing a proposal that would result in a mandatory operating rule requiring shoulder harness at each seat on aircraft engaged in certain types of flight operations.

• STOL Or No STOL

Since STOL modifications have been approved for most popular makes of small aircraft, why is it that they are not available from the plane manufacturers like other optional equipment?

H. L. Morgan
Oak Harbor, Washington

Although we cannot answer directly for the manufacturers as to why they do not choose to handle STOL modification kits for their airplanes, we would assume it to be a case of economics. Since many light planes, as certificated, possess quite good takeoff and landing characteristics, the need for the small additional benefit a STOL kit can provide is somewhat limited.

If you wish to pursue this inquiry further, it may be worthwhile to direct your question to one of the larger manufacturers of light aircraft.

• Your Friendly FAA

Last summer I took my shiny new private pilot's license and my family on a 4,000 mile trip where I encountered about every VFR situation one could find. I quickly learned that FAA personnel both in towers and in flight service stations are courteous and willing to go out of their way to assist a novice pilot on his first trip.

I must single out Terre Haute, Indiana, for the highest praise. The tower and station personnel were tops. Upon learning that I had never been to this airport before, the tower operator guided me to the tie-down area near the terminal. Station personnel assisted me in getting a special VFR clearance for our takeoff for home.

My thanks to the wonderful FAA people who took the apprehension out of our first trip.

Roger F. MacDonald
Aurora, Colorado

• Commercial Pilot Training

I would like information concerning a career as a commercial pilot. I am interested in learning about the required training, and alternative ways of meeting the qualifications and requirements. Do you have a list of private training schools, public colleges and universities which offer some kind of pilot training or technology?

Charles A. Hammond
Provo, Utah

The FAA Student Pilot Guide answers many questions concerning pilot training. The requirements for a commercial airplane pilot are found in Part 61 of the Federal Aviation Regulations.

Part 61 cannot be obtained separately, but is published in Volume IX of the FARs, available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, for $6.00.

The current list of Certificated Pilot Flight and Ground Schools identifies with asterisks those schools conducted by accredited colleges and universities.

Also the Aviation Education Division of the Office of General Aviation Affairs, Federal Aviation Administration, Dept. of Transportation, Washington, D.C. 20590, has available a publication entitled "Aviation and Transportation Majors and Curricula Offered by Colleges and Universities" which may be of use to you.

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. No anonymous letters will be used, but names will be withheld on request.

• Have Duster License—Will Travel

In the October issue you told an Army helicopter pilot where he could write about employment.

I am a U.S. resident with a U.S. commercial license and 700 hours of crop-dusting in Mexico. Where and to whom can I write for employment in crop-dusting and in industrial aviation in the United States? I am willing to go anywhere.

Armando Antunano
San Bruno, California

The National Agricultural Aviation Association will be glad to try to find some employment contacts for you in the field of aerial applications if you write directly to them listing your experience and qualifications in detail. Their address is: 1101 17th Street, N.W., Washington, D.C. 20036.

• Homemade Landing Strip

I always wanted to learn to fly so at age 61 I received my private pilot's license. I purchased a 140 Cessna and have a strip of land on my farm over 2,000 feet long suitable for landing. Are there any regulations on flying my plane from my farm?

Louis Marsden
Edgerton, Wisconsin

Federal law requires you to file a Notice of Use with FAA through your local GADO or regional office. Since local licensing requirements differ from state to state, we suggest that you contact your State aviation authority for specifics.

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WASHINGTON, D. C. 20590

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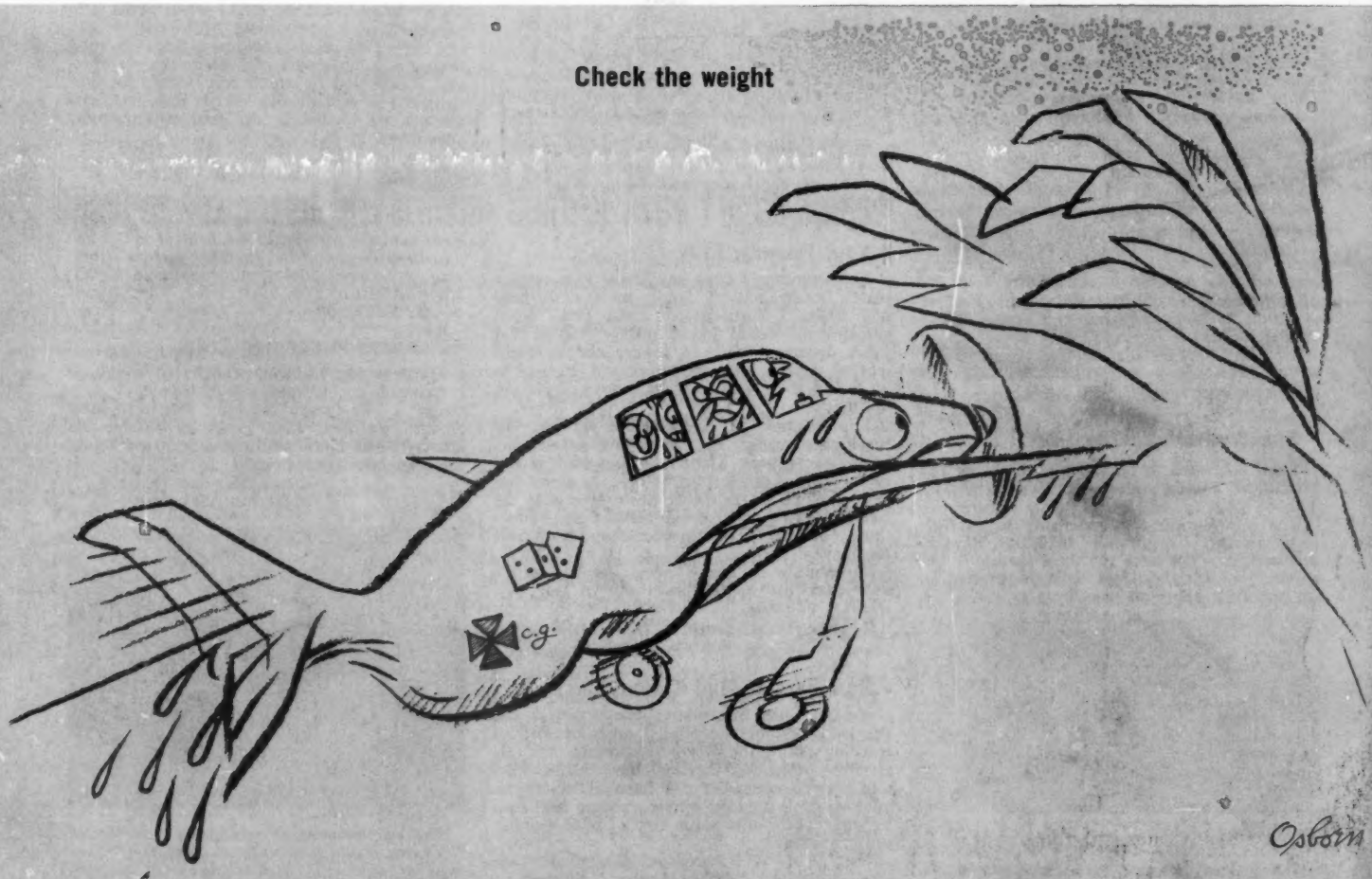
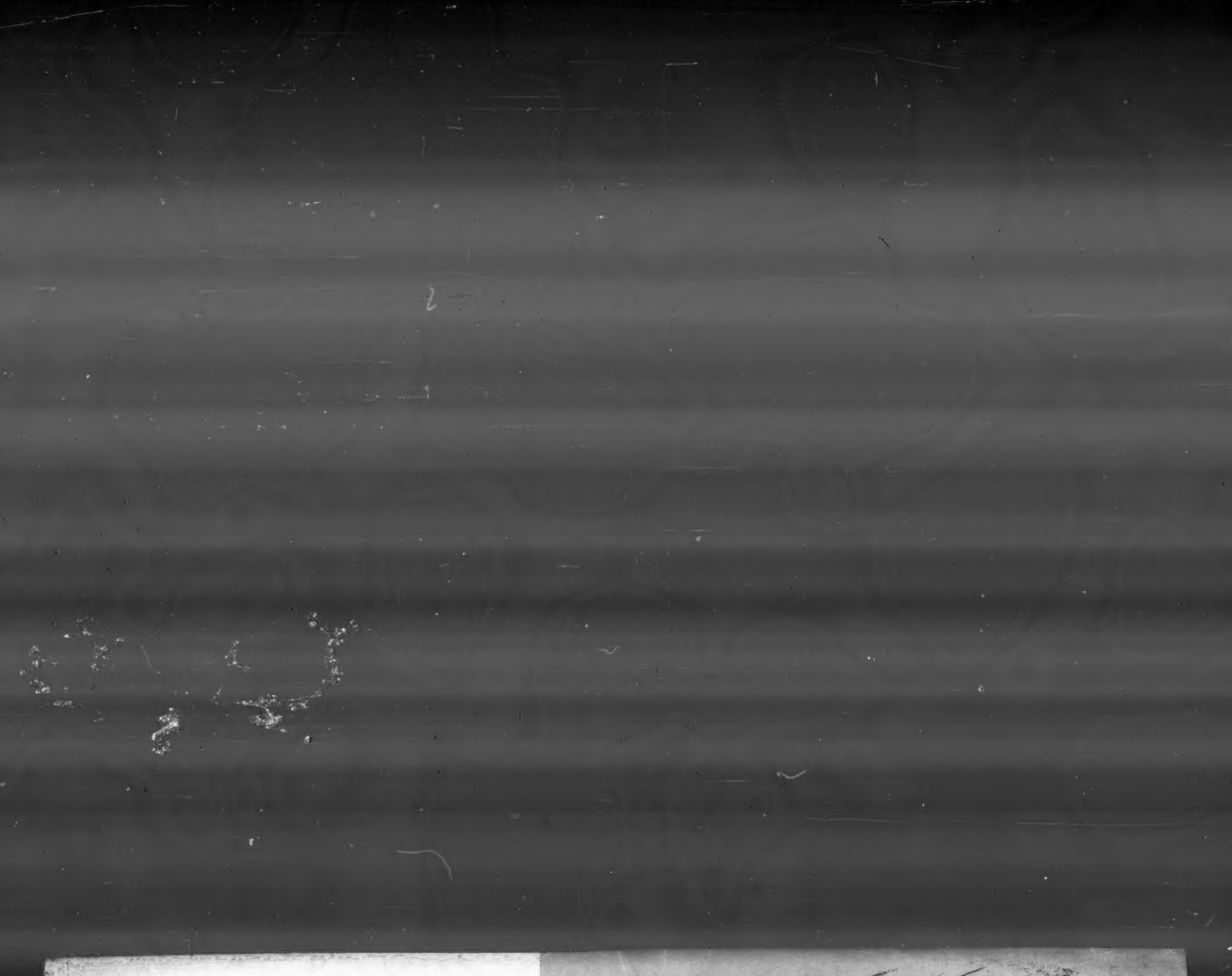


Don't gamble with fate

Sarah H. Bollinger
SO-ACDO-#33
Winston-Salem, N.C.